

In the Claims

1. (Currently amended) A method of testing equipment operatively connected to a target medium having a protocol, comprising:

providing a plurality of communication element types hierarchically representing different communication elements ~~of for the respective protocol, each communication element type being a user-defined instantiable software data type pertaining to a particular layer of the protocol;~~

providing an electronic instrument for operatively connecting to the equipment over the target medium;

~~providing and operating under control of a software program for controlling the electronic instrument;~~

instantiating, by the software program, ~~at least one of the plurality of communication element types to create a transmit message instance within the software program, the transmit message instance being a specific expression of the respective communication element type;~~

instantiating, by the software program, ~~at least one of the plurality of communication element types to create an expect message instance within the software program, the expect message instance being a specific expression of the respective communication element type;~~

~~manipulating the transmit message instance within the software program;~~

~~manipulating the expect message instance within the software program;~~

directing, by the software program, the electronic instrument to transmit a message to the equipment according to the manipulated transmit message instance and to receive a message from the equipment according to the manipulated expect message instance; and

comparing the message received from the equipment with expected results to determine whether expected results were obtained,

~~wherein each communication element type is a user-defined data structure that pertains to a particular layer of the protocol, and~~

wherein at least some communication element types relating to higher layers of the protocol include references to one or more communication element types relating to lower layers of the protocol.

2. (Canceled)

3. (Previously presented) A method as recited in claim 1, wherein the step of providing a plurality of communication element types comprises defining one or more of the plurality of communication element types responsive to exchanges allowed by the protocol of the respective target medium.

4. (Canceled)

5. (Previously presented) A method as recited in claim 1, wherein at least one of the plurality of communication element types defines a structure for transmitting data over the target medium.

6. (Previously presented) A method as recited in claim 1, wherein at least one of the plurality of communication element type defines a structure for receiving data over the target medium.

7. (Original) A method as recited in claim 1, wherein at least one communication element type is a message type that includes a portion for holding message data associated with instances of the respective message type.

8. (Original) A method as recited in claim 7, wherein the message data has a fixed length.

9. (Original) A method as recited in claim 7, wherein the message data has a variable length.

10. (Previously presented) A method as recited in claim 1, wherein at least one of the communication element types has a fixed portion that is the same for all instances of the communication element type.

11. (Canceled)

12. (Original) A method as recited in claim 1, wherein the plurality of communication element types includes at least one message type, and each instance of the message type includes a portion for prescribing timing.

13. (Previously presented) A method as recited in claim 12, wherein the timing includes a setting for specifying a pre-message gap.

14. (Original) A method as recited in claim 12, wherein the timing includes a setting for specifying a pre-word gap.

15. (Original) A method as recited in claim 12, wherein the timing includes a setting for specifying a begin message timeout.

16. (Original) A method as recited in claim 12, wherein the timing includes a setting for specifying a trailing gap.

17. (Currently amended) A method of as recited in claim 1, ~~wherein the step of manipulating the transmit message instance comprises~~ further comprising, prior to the step of directing:

~~establishing~~ varying at least one characteristic of the transmit message instance by the software program.

18. (Previously presented) A method as recited in claim 17, wherein the at least one characteristic includes a timing characteristic.

19. (Previously presented) A method as recited in claim 1, further comprising:

saving the plurality of communication element types in a computer readable format.

20. (Previously presented) A method as recited in claim 1,

wherein the plurality of user-definable communication element types include message types, word types, and field types,

wherein at least one message type includes a reference to at least one word type, and

wherein at least one word type includes a reference to at least one field type.

21. (Currently amended) A method as recited in claim 14, further comprising creating multiple instances of one of the plurality of communication element types.

22. (Previously presented) A method as recited in claim 21, further comprising processing each of the multiple instances for exchanging information on the target medium.

23. (Previously presented) A method as recited in claim 17, further comprising creating multiple instances of one of the plurality of communication element types in the software program.

24. (Previously presented) A method as recited in claim 23, further comprising, varying characteristics of each of the multiple instances created in the software program in different ways.

25. (Canceled) A method of communicating over a target medium having a protocol, comprising:

providing a plurality of communication element types for representing different communication elements of the protocol, each of the plurality of communication element types being a user-defined data structure that pertains to a particular layer of the protocol,

providing an electronic instrument for operatively connecting to the target medium for communicating over the target medium;

providing a software program for controlling the electronic instrument;

arranging the plurality of communication element types hierarchically, with at least one communication element type relating to a higher layer of the protocol including a reference to at least one communication element type relating to a lower layer of the protocol,

instantiating at least one of the plurality of communication element types by the software program to create at least one communication element instance; and

operating the software program to control the electronic instrument to direct communications over the target medium responsive to each communication element instance.

26. (Currently amended) A method of communicating over a target medium having a protocol ~~that supports the use of messages and words~~, comprising:

providing a plurality of message types and ~~a plurality of~~ word types for representing communications using the protocol, each of the plurality of message types and ~~each of the plurality of~~ word types being a user-definable data ~~structure type represented in software~~;

providing an electronic instrument operatively connecting to the target medium for communicating over the target medium;

providing a software program for controlling the electronic instrument;

arranging the plurality of message types and ~~the plurality of~~ word types hierarchically, with at least one message type including a reference to at least one word type;

instantiating the at least one message type by the software program to create at least one message instance, ~~each message instance being a specific expression of the respective message type and including an instance of each word type included by reference in the respective message type, each included instance of a word type being a specific expression of the respective word type~~; and

operating the software program to control the electronic instrument to direct communications over the target medium, responsive to the ~~at least one~~ message instance.

27. (Currently amended) A method as recited in claim 1, wherein the step of ~~creating at least one instance of an accessed~~ ~~instantiating one of the plurality of~~ communication element types ~~to create a transmit message instance~~ comprises the software program accessing a software applications program interface (API).

28. (Currently amended) A method as recited in claim 1, wherein the step of ~~creating at least one instance of an accessed~~ ~~instantiating one of the plurality of~~ communication element types ~~to create a transmit message instance~~ comprises the software program accessing a VXI plug-and-play driver.

29. (New) A method of communicating over a target medium having a multi-layered protocol, comprising:

providing a software program;

defining a first plurality of communication element types, accessible by the software program and representing different communication elements for a first layer of the protocol;

defining a second plurality of communication element types, accessible by the software program and representing different communication elements for a second layer of the protocol, the second layer being lower than the first layer;

including, within the definition of at least one of the first plurality of communication element types, a reference to at least one of the second plurality of communication element types;

instantiating one of the first plurality of communication element types to create a communication element instance thereof within the software program, the communication element instance including an instance of each of the second plurality of communication element types referenced by said one of the first plurality of communication element types, each instance being a specific expression of the respective communication element type;

manipulating at least one of the communication element instances within the software program; and

executing the software program to communicate over the target medium according to the manipulated communication element instance.

30. (New) A method as recited in claim 29, wherein the first layer of the protocol pertains to messages and the second layer of the protocol pertains to words.

31. (New) A method as recited in claim 29, further comprising:

defining a third plurality of communication element types, accessible by the software program and representing different communication elements for a third layer of the protocol, the third layer being lower than the second layer; and

including, within the definition of at least one of the second plurality of communication element types, a reference to at least one of the third plurality of communication element types.

32. (New) A method as recited in claim 31, wherein the first layer of the protocol pertains to messages, the second layer of the protocol pertains to words, and the third layer of the protocol pertains to fields.

33. (New) A method as recited in claim 29, wherein the first and second plurality of communication element types are stored in a computer-readable file.

34. (New) A method as recited in claim 29, wherein the first and second plurality of communication element types are implemented with XML code.

35. (New) A computer-implemented system for communicating over a target medium having a multi-layered protocol, comprising:

- a software program for controlling an electronic instrument connected to the target medium;

- a bus model file accessible by the software program and including—

- a first plurality of communication element types representing different communication elements for a first layer of the protocol; and

- a second plurality of communication element types representing different communication elements for a second layer of the protocol, the second layer being lower than the first layer,

- each of the first and second plurality of communication element types being an instantiable software data type, and

- at least one of the first plurality of communication element types including a reference to at least one of the second plurality of communication element types;

- a software API (applications program interface), accessible by the software program, for creating communication element instances based on the first and second plurality of communication element types, said communication element instances including—

- at least one first communication element instance within the software program, each being a specific expression of a respective one of the first plurality of communication element types; and

- at least one second communication element instance within the software program, each being a specific expression of one of the second plurality of communication element types included by reference in a respective first communication element type.

36. A computer-implemented system as recited in claim 35, wherein the first and second plurality of communication element types are implemented using nested software tags.

37. A computer-implemented system as recited in claim 36, wherein the bus model file is an XML file.

38. A computer-implemented system as recited in claim 35, wherein the bus model file further includes a third plurality of communication element types, accessible by the software program and representing different communication elements for a third layer of the protocol, the third layer being lower than the second layer, and at least one of the second plurality of communication element types including a reference to at least one of the third plurality of communication element types.